Explaining Endothermic and Exothermic Reactions

QUESTION: Explain the following Endothermic and Exothermic reactions

1) a) Some Bunsen burners use methane gas, CH_4, as a fuel. The reaction for the combustion of methane in a Bunsen burner is shown in **Equation One** below.

Equation One: $CH_4 + 2O_2 \rightarrow CO_2 + 2H_2O$ $\Delta rH = -889$ kJ mol^{-1}

When this reaction occurs, bonds are broken and bonds are formed.
State which bonds are broken and which bonds are formed during the reaction

b) The equation for water boiling at 100°C is shown below in **Equation Two**.

Equation Two: $H_2O(\ell) \rightarrow H_2O(g)$ $\Delta rH = 40.7$ kJ mol^{-1}

Explain why this equation is endothermic.

You should relate the energy changes that are occurring to the specific bonds being broken or formed.

2) a) Ice melting to form water can be represented by the following equation:

$H_2O(s) \rightarrow H_2O(\ell)$

State whether the reaction is Endothermic or Exothermic and give reasons for your choice

b) The reaction between hydrogen gas and oxygen gas to form water in the gaseous state can be represented by:

$2H_2(g) + O_2(g) \rightarrow 2H_2O(g)$

When this reaction occurs, bonds are broken and bonds are formed.
State which bonds are broken and which bonds are formed.
The bond breaking and bond forming processes above can be described as EITHER **exothermic** OR **endothermic**.
State which process is exothermic and which process is endothermic and Explain your answer.

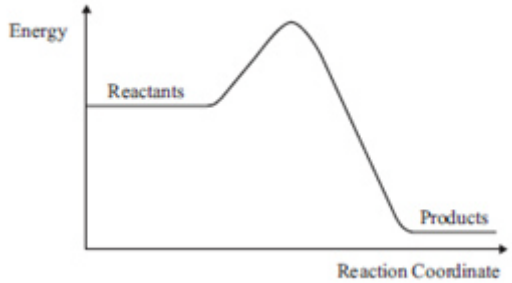
3) a) For the reaction $4NH_3(g) + 5O_2(g) \rightarrow 4NO(g) + 6H_2O(g)$,

the enthalpy of reaction is $\Delta_r H = -950$ kJ mol^{-1}.

The reverse reaction is $4NO(g) + 6H_2O(g) \rightarrow 4NH_3(g) + 5O_2(g)$

Two energy diagrams are shown below. One is for the forward reaction and one is for the same reaction in the reverse direction.

Diagram One



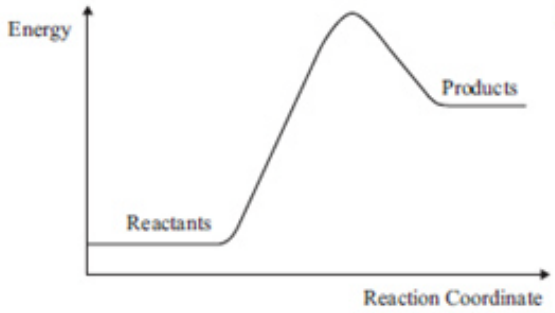
Exothermic or **Endothermic**

(circle one)

Forward or **Reverse**

(circle one)

Diagram Two



Exothermic or **Endothermic**

(circle one)

Forward or **Reverse**

(circle one)

i) For each diagram, indicate whether the diagram is for an exothermic reaction or an endothermic reaction

ii) For each diagram, indicate whether the diagram is for a forward or reverse reaction

iii) On the diagrams for both reactions, also label the following:

- enthalpy of reaction, $\Delta_r H$
- Activation Energy, E_a.

iv) Determine the value for the enthalpy of reaction ($\Delta_r H$) for the reaction shown in Diagram Two. Explain how you determined this value.